REMARKS

In this response, claims 1, 3, 5, 14, 16, 18 and 28 have been amended. Claims 29-30 have been added and no claims have been canceled. Accordingly, claims 1-30 remain pending in the present application. Reconsideration of the above-identified patent application is hereby requested.

DRAWINGS

The Examiner has objected to the drawings under 37 CFR 1.83(a). The Examiner alleges that the drawings do not show the hemispherical bottom having a diameter greater than the diameter of the opening in which it is disposed, as is claimed in claim 3. Applicant respectfully disagrees. Figure 13, for example, shows a hemispherical bottom that has a diameter that is greater than the diameter of the opening in which it is disposed. Accordingly, applicant respectfully requests withdrawal of the objection.

SPECIFICATION

The Examiner has rejected the specification under 35 U.S.C. § 112, first paragraph for failing to provide an adequate written description. The Examiner contends that it is not clear how the materials feldspar, magnesium oxide or zirconium oxide would emit far infrared radiation.

With regard to the infrared (IR) emissive properties of the far-infrared converting materials, Applicant respectfully submits that it is known that certain materials will emit IR radiation based on its exposure to light or other sources of energy. For

example, feldspar, one of the materials provided as an exemplary coating in the application, is known to emit IR energy. Applicant respectfully encloses two print outs from the Thermal Infrared Mineral Spectroscopy Laboratory website at Arizona State University. The first, found as of the date of this response at http://tes.asu.edu/newlab.html (see attached), discusses the study of various Earth minerals (including feldspar) and materials through the measurement of infrared spectroscopy. The second, found as of the date of this response at http://tes.asu.edu/MARS_SURVEYOR/MGSTES/TES_emissivity.html (see attached), discusses emissivity in general.

In addition, as described in an article dated January 1, 2004, from photonics.com, available as of the date of this response at http://www.photonics.com/content/spectra/2004/January/applications/65781.aspx (see attached), emittance has been measured from feldspar in experiments where the material has been exposed to pressure.

CLAIM REJECTIONS UNDER 35 U.S.C. § 112, FIRST PARAGRAPH

The Examiner has rejected claim 3 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The examiner contends that the claim contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner alleges that "neither the specification nor the drawings detail the hemispherical bottom having a diameter greater than the diameter of the opening." Page 3, Office Action mailed January 27, 2006 ("01/27/06 Office

Action"). Reconsideration and withdrawal of this rejection is requested in view of the following discussion.

Applicant respectfully traverses the Examiner's rejection. As discussed above with respect to the drawings objection, Figure 13 shows a hemispherical bottom having a diameter greater than the diameter of the opening.

In view of the explanation above, Applicant asserts that the Specification as filed complies with 35 U.S.C. § 112, first paragraph. Thus, Applicant respectfully requests that the § 112 objection to the Specification and the rejection of claim 3 be withdrawn.

The Examiner has rejected claims 11 and 23 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The examiner contends that "it is unclear how the far-infrared converting material would actually function to radiate far infrared radiation or heat." Page 4, 01/27/06 Office Action. A discussion of the far infrared converting materials is set forth above.

In view of the explanation above, Applicant asserts that the Specification as filed complies with 35 U.S.C. § 112, first paragraph. Thus, Applicant respectfully requests that the § 112 rejection of claims 11 and 23 be withdrawn.

CLAIM REJECTIONS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

The Examiner has rejected claim 1 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to

particularly point out and distinctly claim the subject matter which the Applicant regards as the invention. The Examiner alleges that "it is unclear whether the massage protrusion or the massage pad structure has a chamber accessible through an opening." Page 4, 01/27/06 Office Action. In light of the Examiner's objections to claim 1, Applicant has amended claim 1 to recite "the massage pad structure having a chamber accessible through an opening on a top surface thereof," to clarify that the massage pad structure includes the chamber accessible through an opening.

In view of the amendment, it is believed that claim 1 now complies with 35 U.S.C. § 112, second paragraph. Thus, Applicant respectfully requests that the § 112, second paragraph, rejection be withdrawn.

CLAIM REJECTIONS UNDER 35 U.S.C. § 102(b)

The Examiner has rejected claims 1-3, 6-8, 14-16, 19, 20 and 28 under 35 U.S.C. § 102(b) as being anticipated by Chang, U.S. Patent No. 5,682,690 (herein Chang). Reconsideration and withdrawal of this rejection is requested in view of the amendments and addition made to the claims and of the following discussion.

It is axiomatic that for a reference to be anticipatory, each and every feature in the claims must be disclosed by the single reference. Amended claim 1 recites "a hemispherical top movably disposed on, and <u>tiltable</u> with respect

to, the top surface." (emphasis added). Independent claims 14 and 28 include similar limitations.

Applicant's invention provides the ability for the massage protrusion to tilt with respect to the top surface. See Figure 7 and paragraph [29] of the specification. The alleged massage protrusion of Chang only moves in a vertical direction and cannot tilt with respect to the alleged top surface. No mention of the alleged massage protrusion being able to tilt is found in this reference.

Applicant notes that independent claims 1, 14 and 28 contain the above-described tiltability limitation and dependent claims 2-13, 15-27 and 29-30, by virtue of depending on these independent claims, also contain the same limitation. Therefore, Applicant submits that these claims are allowable for the same reasons as discussed above.

In view of the foregoing discussion and the amendments made to the claims, Applicant submits that the § 102(b) rejections are overcome. Thus, Applicant respectfully requests that the § 102(b) rejections be withdrawn.

REJECTIONS UNDER 35 U.S.C. § 103

The Examiner has rejected claims 4, 5, 9, 10, 12, 13, 17, 18, 21, 22, and 24-27 under 35 U.S.C. § 103(a) as being unpatentable over Chang either alone or in combination with Horibata, Shen or Kim.

Applicant notes that independent claims 1, 14 and 28 contain the tiltability limitation described by Applicant with regards to the 35 U.S.C. § 102(b) rejection. Dependent claims 4, 5, 9, 10, 12, 13, 17, 18, 21, 22, and 24-27, by virtue of depending on these independent claims, also contain the same limitation. As Chang, neither alone nor in combination with Horibata, Shen or Kim, teach or suggest these limitations. Applicant submits that these claims are allowable for the same reasons as discussed above.

In view of the foregoing discussion, Applicant submits that the § 103 rejections are overcome. Thus, Applicant respectfully requests that the § 103 rejections be withdrawn.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

Respectfully submitted,

JEFFER, MANGELS, BUTLER & MARMARO LLP

Dated: 6/27/2006

By: [signature]

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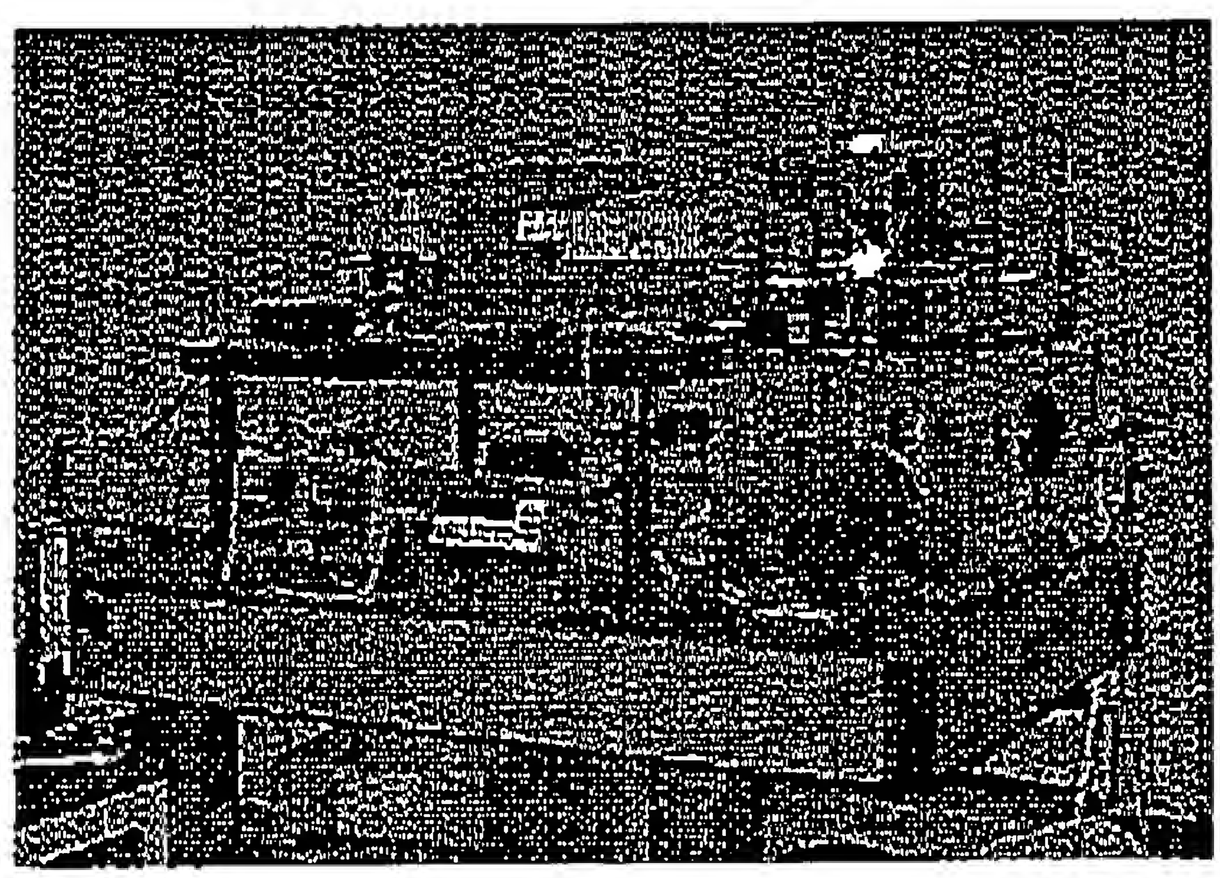
ASU Thermal Infrared Mineral Spectroscopy Laboratory

The Laboratory

The Mars Thermal Emission Spectrometer research group at ASU is busy compiling a spectral library of Earth's minerals and rocks for comparison to spectra to be obtained from Mars. The spectral library will also be useful for interpreting remote sensing data of Earth.

For a short tutorial on what thermal infrared energy is, how we measure it, and why we use it for looking at rocks and minerals, see the What is TES? page.

Our Nicolet Nexus 670 is shown below with the emission sample chamber on the right. An annotated version of this picture is available here. This new spectrometer allows us to obtain data from 4000-200 cm^{-1} (~2.5 - 50 microns). To learn more about our spectrometer configuration and calibration, please see Ruff et al. [1997] on the References page. A picture of our previous Mattson Cygnus 100 spectrometer is also available.



As part of our work, we have a separate laboratory for sample preparation. Separation of samples by particle size and mineral content is key to understanding the fundamental infrared signature of rocks.

Research Projects

There are many people at the ASU TES facility who are engaged in active research projects involving the study of rocks and minerals in the lab and via remote sensing. Follow the links below to find out about some of these research projects.

Mars Geology
Since the Viking orbiters and landers returned a wealth of information about the Red Planet in the mid-1970's, scientists have been interpreting a great deal about the history of the planet's surface, sometimes augmenting the Viking datasets with other planetary and laboratory data. Go to our References page to see a list of some of the professional papers that have been written by ASU TES scientists.

Spectral Library
Everyone contributes to the ASU TES spectral library, which currently contains over 150 pure mineral samples, more than 100 rock samples, and six martian meteorites. This infrared emission plot shows the differences between the major silicate structural groups (noted below the mineral name). As the silicate structure becomes depolymerized (from framework through chain to isolated structures), the location of the short wavelength absorptions (between 8 and 12 microns) shifts to longer wavelengths. This provides a quick way of discriminating mineral classes.

Rock-Forming (Silicate) Minerals
Silicates have variable structures, but all contain a basic Si-O tetrahedral anion; various cations are bonded to these anions to form minerals such as quartz, feldspar, mica, etc.

> ***Feldspars:***Feldspars as a group are the most common minerals in the Earth's crust, occurring in many types of rocks. They are probably quite common in Mars rocks as well. The different varieties of feldspars cover a range of compositions and structures. These variations can be used to understand the conditions under which igneous rocks form. The ability to distinguish the different feldspars is key to this heightened understanding. Thermal emission spectroscopy is proving to be a capable tool for this application. See Steve Ruff's feldspar page.
>
> ***Pyroxenes:***These mafic minerals are most commonly found in dark volcanic rocks, such as basalts. Much if not most of the martian surface is expected to be composed of basaltic or related types of rocks. If two or more pyroxenes are present in these rocks, their compositions can be used to determine the temperature and pressure conditions of the melt from which the rocks were derived. By making maps of pyroxene composition and abundance as a function of location and age, we hope to learn

a great deal about the evolution of igneous processes on the surface and in the interior of Mars. To look at spectra of these minerals, see Vicky Hamilton's pyroxene page.

Carbonates and Other Salts
Carbonates are based not on a Si-O anion, but on a CO3 anion. Carbonates, sulfates, phosphates, and chlorides are sometimes referred to as "evaporites" because often these minerals precipitate from water. The TES team will be looking for evaporites on Mars because, if detected, they may provide insight into the chemistry of water on Mars and how long it was available on the planet's surface to aid the weathering of the martian rocks and to interact with the atmosphere. Water is thought to be a critical necessity for the support of life, thus finding water-lain minerals may provide clues to where to look for biological material. See spectra on Melissa Lane's carbonate page or her phosphates, sulfates, and chlorides page.

Martian Meteorites
Until rocks are brought back to Earth from Mars someday, the only samples of the Red Planet that we have are the martian meteorites. Most scientists believe that these meteorites are from Mars due to special characteristics that make them different from all other meteorites and terrestrial rocks. All of these pieces of Mars are igneous rocks that are basaltic or ultramafic (containing mostly Mg-rich and Fe-rich minerals) in composition. To see the thermal infrared spectra of a few of these meteorites, go to Vicky Hamilton's martian meteorites page.

Terrestrial Rocks
Studies of minerals are very useful for learning about the spectral differences in minerals that can have variable structures or compositions, but in the natural environment, very few minerals occur alone in large quantities -- most minerals are found with a group of other minerals in rocks. Look here to see the spectra of some common igneous rocks and metamorphic rocks.
Spectra courtesy K. C. Feely (Master's Thesis).

Terrestrial Remote Sensing
Several research projects by ASU TES scientists involve remote sensing studies of locations on Earth, particularly in the desert southwest and volcanic provinces of the west coast of the United States. Much of this research involves the application of linear deconvolution, a technique which allows us to determine not only the composition, but also the abundances of minerals in thermal infrared spectra.

Additional studies involve understanding hillslope sediment transport, soil development, and aeolian processes via the characterization of arid hillslope soils using remotely acquired thermal IR spectra, VIS/NIR spectra, and radar. This work also investigates the role of desert vegetation in sediment transport and soil development. See Will Stefanov's page about remote sensing of Arizona and the Geological

Remote Sensing Laboratory homepage.

Arizona Remote Sensing

The TES facility is also home to the Arizona State University Landsat Image Server, which contains Landsat data for the entire state of Arizona (accessible to students, faculty, and staff of Arizona State University). We are also involved with the City of Scottsdale, Arizona, bringing remote sensing to urban applications.

JPL Mars Missions Homepage | WHAT is TES? | Lab Spectroscopy
K-12 Outreach | ASU Facility & People | Mars Links | Glossary
ASU Planetary Exploration Lab Homepage

Credits

What is Emissivity?

A Blackbody: the Perfect Emitter

Imagine looking into a small opening of a deep cave. In the visible wavelengths, the opening looks black because the light that enters the cave is not easily reflected back out. However, the cave glows with emitted thermal IR energy. This energy emerges as a complete spectrum of all wavelengths of IR light. The radiance at each infrared wavelength is the maximum amount possible for a given temperature. If we used an infrared spectrometer to measure this emitted energy and plotted the result, it would follow a Planck distribution.Anything that emits energy with a Planck distribution can be called a blackbody. A blackbody emitter is useful for comparison with materials that do not emit perfectly at all wavelengths, which is the case for most of the matter in the universe.

A Universe of Selective Emitters

The molecules that form the stuff of the universe (gases, liquids, and solids) result from atoms bonding together. They behave like microscopic balls on the ends of molecular springs, vibrating when agitated. This agitation arises when light of just the right wavelength hits a particular molecule. Once it starts vibrating, the molecule re-radiates the same wavelength of light. This is the process of absorption and emission. The wavelengths of light that cause molecular vibrations occur in the infrared region. Every unique molecule has its own characteristic frequency of vibration. So, unlike a blackbody emitter, molecules emit energy that departs from a Planck distribution. This means that the infrared light emitted by vibrating molecules can be used to identify them.

Emissivity: the Temperature Equalizer

One of the ways to describe the infrared energy emitted by molecules is in terms of radiance: watts of energy per unit of area. With changes in temperature, come changes in radiance. For example, the radiance from a mineral at one temperature will be different from that at another temperature. In order to make comparisons of emission from materials at different temperatures, we need to remove the temperature effect. This is done mathematically by dividing the radiance spectrum of a selective emitter by that of a blackbody (perfect emitter) at the same temperature. The result is called an emissivity spectrum. Because it results from dividing one radiance spectrum by another, the units of watts/area cancel. Emissivity then, is a fractional representation of the amount of energy from some material vs. the energy that would come from a blackbody at the same temperature. The places in an emissivity spectrum that have a value less than one are the wavelength regions that molecules are absorbing energy. In the case of quartz (SiO_2), the silicon-oxygen molecules are responsible for the absorptions.

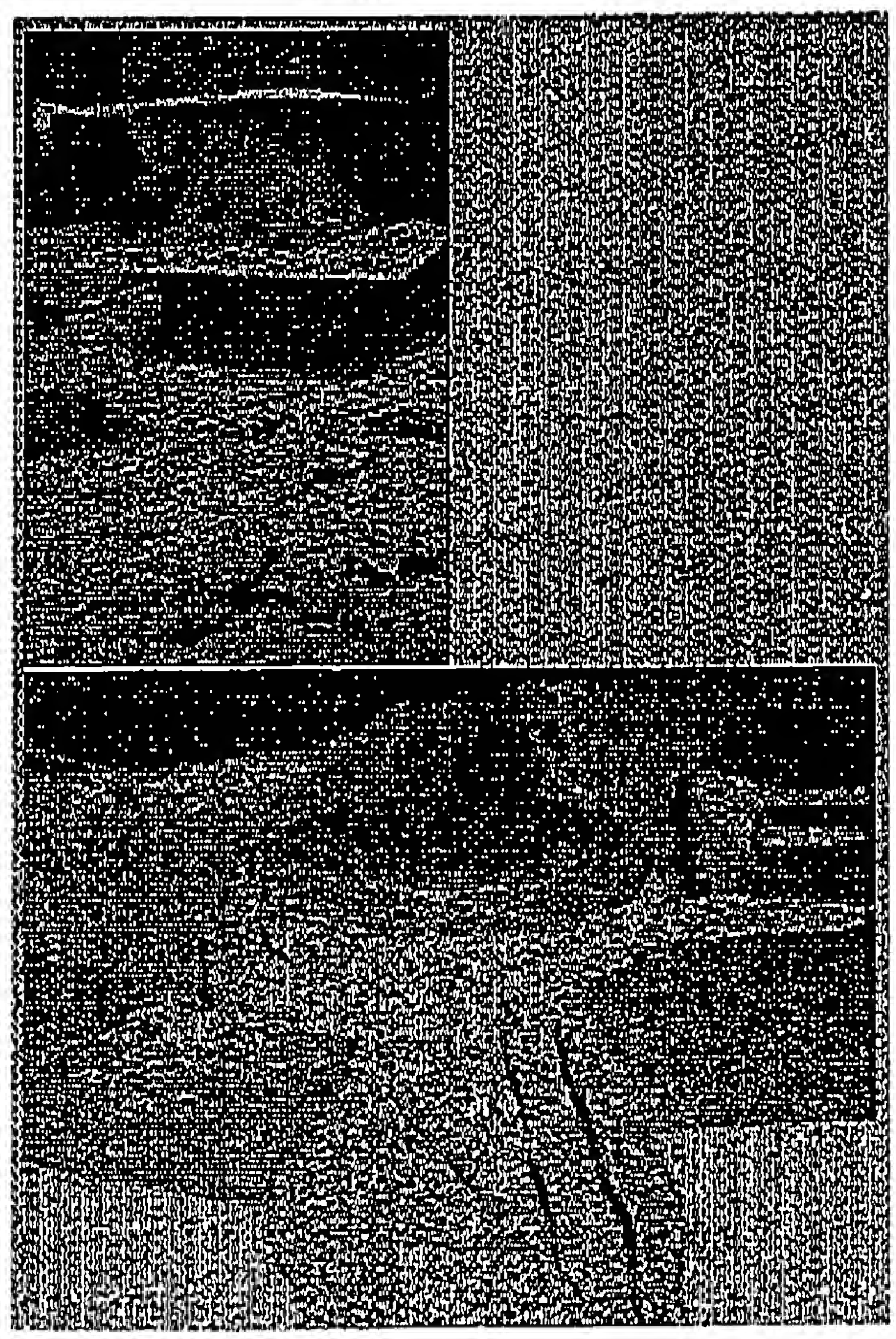
proceed to What is the emissivity from mixtures of materials?
back to What is TES?

from photonics.com - 1/1/2004
http://www.photonics.com//content/spectra/2004/January/applications/65781.aspx

Spectrophotometer Observes Radiation from Rocks

Brent D. Johnson

A few years ago, Friedemann Freund, a professor at San Jose State University in California, embarked on the study of rock deformation. When you squeeze a rock very hard, asked the physicist, what are the physical processes that take place? The data he is collecting with an infrared spectrophotometer promise to provide insights into the geological phenomena that precede earthquakes.



Infrared analysis of stressed samples of rock may offer a better understanding of geological phenomena associated with earthquakes. It is believed that charge carriers become activated when rocks are subjected to short, intense stresses and that the recombination of these carriers produces infrared radiation.

Freund said that images taken with National Oceanographic and Atmospheric Administration and NASA satellites reveal a strange phenomenon: Prior to a major earthquake, the areas where stresses build up deep in the underground often seem to heat up for a few days. He had the idea that what these satellites record as thermal anomalies may in fact be caused by a form of IR luminescence involving electronic charge carriers. In this model, the charge carriers become activated when rocks are stressed to the point of plastic deformation.

To test this, Freund applied sudden, short stresses to rocks by shooting them with a crossbow and with NASA's Ames Vertical Gun Range, a two-stage, light-gas gun that can accelerate 0.25-in. projectiles to

velocities of approximately 6.5 km/s. The impacts with the crossbow projectiles created small but intense deformations at the impact points and freed a cloud of electric charges that had existed in the rocks in an electrically inactive, dormant state. The charge clouds propagated at several hundred meters per second, even speeding through portions of the rocks that had not experienced stress.

There were also some high-frequency components, in the range of radio frequencies, which probably arise from the buildup of electric fields at the rock surface; in particular, at the corners and edges. These local fields are so high that they can produce corona discharges accompanied by visible light.

Intrigued by these observations, Freund squeezed rock samples in a hydraulic press until they failed. At first, he used slabs of granite, which is common in the Earth's crust. The stone contains large amounts of quartz, which develops an electric charge when squeezed. Next, he used quartz-free anorthosite, a rock composed almost entirely of labradorite, a feldspar known for its iridescence. Only the central part of each block was compressed, leaving the periphery largely stress-free. During the experiments, he measured the emissions from the rock surface with an IR spectrophotometer from ABB Inc. of Quebec.

Freund recorded a specific IR emission from the rock surface, 10 to 20 cm away from the point where the rock was being squeezed. The emission occurs so rapidly, he explained, that it cannot be propagating heat. Its spectrum has several components, including a narrowband one that occurs where theory predicts the emission band should be from the recombination of the charge carriers.

Freund plans more experiments to study the phenomenon in greater detail. Although he is unwilling to make any firm statement at this time, he believes that the discovery of the dormant electronic charge carriers in rocks, which can be awakened by stress, opens the door to a better understanding of geological phenomena from the thermal anomalies in satellite images to the "earthquake lights" photographed in Japan.

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from photonics.com - 1/1/2004
http://www.photonics.com/content/spectra/2004/January/applications/65781.aspx